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## Report on Freshwater Planarians from Malaya and Thailand

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Dr. M. HIRANO of Yoshida College, Kyoto University, a member of "The Kyoto University Biological Expedition to Thailand and Malaysia, 1967", entrusted the author with his collection of freshwater planarians of Malaya and Thailand. The material, which was fixed on the field in 80% ethyl alcohol, consists of five vials of specimens. After examination of preserved specimens under a binocular microscope, it is found out that only one specimen from the Malayan locality (the Sungai Gombak) is in a sexually mature state. The author have made a series of sections of the animal (stained with Delafield's haematoxylin and eosin). This Malayan triclad species was identified as *Dugesia batuensis* BALL, 1970, the hypogean species reported from small guano pools in the Batu Caves (cf. BALL, 1970; KAWAKATSU, 1972 b). The animals from four localities in Thailand are probably classified to the genus *Dugesia* (presumably one species), but none of the animals are sexually mature.

In the present paper, some additional morphological and anatomical observations of *Dugesia batuensis* based upon the animals from the epigeal locality, as well as of planariid species from Thailand, will be described, together with some remarks on the taxonomy of triclads from the Malay Peninsula and the Indochina Peninsula.

The author is indebted to Dr. Minoru HIRANO, Professor of Botany of Yoshida College, Kyoto University, for this interesting material. The author is also indebted to Dr. Riôzô YOSII, Professor of Zoology of the same college, as well as Dr. HIRANO, who has kindly provided the chance of this publication for the present author in their Contributions from the Biological Laboratory, Kyoto University.

### List of Localities and the Species Obtained<sup>2)</sup>

Following is the list of the two groups of planarians upon which this paper is based, with pertinent collection data by Dr. HIRANO (Fig. 1). The number following each station number indicates the specimen lot number as it is registered in KAWAKATSU's fixing notebook. The altitude of each station is somewhat incorrectness.

No. 1. Specimen Lot No. 765. A small tributary of the Sungai Gombak, the north-east part of Kuala Lumpur, in the state of Selangor, Malaya. Altitude, about 100 m. August 6, 1967. Water temp., about 28°C. About 20 specimens of *Dugesia batuensis* BALL, 1970. Only one specimen of them was observed in a sexually mature state (10 mm long and 1 mm broad). Coll. Dr. M. HIRANO.

1) Biological Laboratory, Fuji Women's College, Kita-16, Nishi-2, Sapporo (Hokkaidô) 065.

2) "Sungai" and "Lam", the spot language, river. "Huai", the spot language, brook or brooklet which find only in the rain season.

No. 2. Specimen Lot No. 766. A small stream in the Khao Chong National Park in the southern part of Thailand. Altitude, about 300 m. August 21, 1967. Two specimens of *Dugesia* sp. (species of Thailand). All of them were observed in

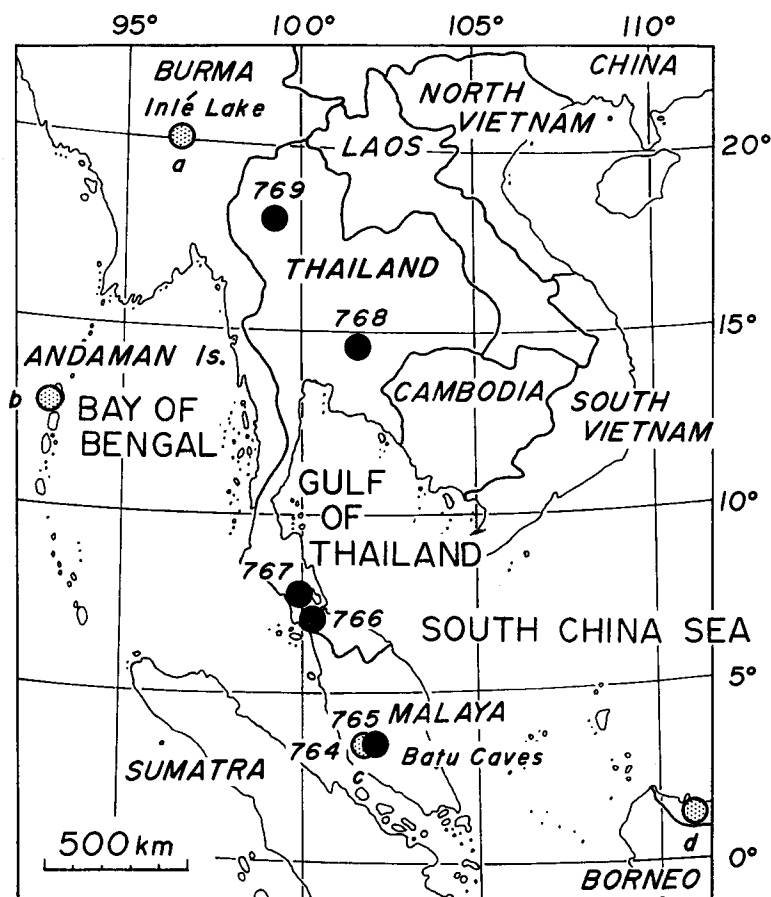


Fig. 1. Sketch map of the South-east Asian countries, showing stations where planarians were recorded. Solid circles (Nos. 765-769) indicate the stations reported in the present paper. Dotted circles (a-d) indicate the stations reported in the previous papers (KABURAKI, 1918, 1925; KAWAKATSU, 1972 a and b; BALL, 1970).

St. 765: the Sungai Gombak (locality of an epigeal form of *Dugesia batuensis*). Sts. 766-769: localities of *Dugesia* sp. (species of Thailand). St. 766: the Khao Chong National Park. St. 767: the Huai Khaew Patalung National Park. St. 768: a small tributary of the Lam Huai Takhrong River. St. 769: the Huai Pu River. a: Inlé Lake in Burma—localities of *Dugesia burmaensis* (KABURAKI, 1918), *Dugesia annandalei* (KABURAKI, 1918) and "*Planaria bilineata*" KABURAKI, 1918. b: the Andaman Islands—the type locality of *Dugesia andamanensis* (KABURAKI, 1925). c: the Batu Caves in Malaya—the type locality of *Dugesia batuensis* BALL, 1970 (St. 764). d: the Sungai Jaglang in Borneo—the type locality of *Dugesia borneana* KAWAKATSU, 1972.

a sexually immature state (3 mm long and 0.5 mm broad). Coll. Dr. M. HIRANO.

No. 3. Specimen Lot No. 767. A small stream in the Huai Khaew Patalung National Park, Patalung, in the southern part of Thailand. Altitude, about 300 m. August 23, 1967. Two specimens and one fragment of *Dugesia* sp. (species of Thailand). All of them were observed in a sexually immature state (3–4 mm long and 0.5 mm broad). Coll. Dr. M. HIRANO.

No. 4. Specimen Lot No. 768. A small tributary of the Lam Huai Takhrong River in the central part of Thailand. Altitude, about 300 m. August 30, 1967. One fragment of *Dugesia* sp. (species of Thailand) (3 mm long and 0.5 mm broad). Coll. Dr. M. HIRANO.

No. 5. Specimen Lot No. 769. A stream of the Huai Pu River, Ban Thung Phrao Village, Amphoe Mac Sariand district, in the north-western part of Thailand. Altitude, about 200 m. September 12, 1967. Two specimens of *Dugesia* sp. (species of Thailand). All of them were observed in a sexually immature state (6–8 mm long and 1 mm broad). Coll. Dr. M. HIRANO.

#### Order TRICLADIDA

#### Suborder PALUDICOLA or PROBURSALIA

#### Family PLANARIIDAE

#### Genus *Dugesia* GIRARD, 1850

#### *Dugesia batuensis* BALL, 1970

Figs. 2 (A, B and C) and 3; Pls. 1 (A and D) and 2 (A and B)

*Dugesia batuensis* BALL, 1970. Zool. Jour. Linnean Soc., 49: 278–285, Figs. 4–6, Pl. 1, Figs. B–F, Pl. 2, Figs. A and B. Original description.

*Dugesia batuensis* BALL, 1970, in KAWAKATSU (1972 b). Bull. Nat. Sci. Mus.

Tokyo, 15: 339–346, Figs. 1–3, Pl. 1, Figs. A–D, Pl. 2, Figs. A–C, Pl. 3, Figs.

A and B. Additional description of the specimens from the type locality.

External Characters. According to the observations made by the collector (in litt.), the size of the animals (epigeic form) appears to be small in a living state. The head is of a subtriangular form with bluntly pointed auricles. The color of the dorsal side is a uniform dark brown.

The preserved sexually mature animal is 10 mm long and 1 mm wide. The present material fixed in 80% ethyl alcohol shows a slight degree of narrowing behind the head. The posterior end of the body is rather pointed (Fig. 1 A, B and C). All of the specimens examined show a dark coloration. There are numerous, small, blackish brown pigments on the dorsal surface. The margin of the body is light brownish color. An indistinct dark longitudinal band is seen on the midline of the body. The ventral surface is a light brownish gray.

The two eyes, each surrounded by a small clear space, are situated in the usual position. The auricular sensory organ which is an elongated willow-leaf shape is

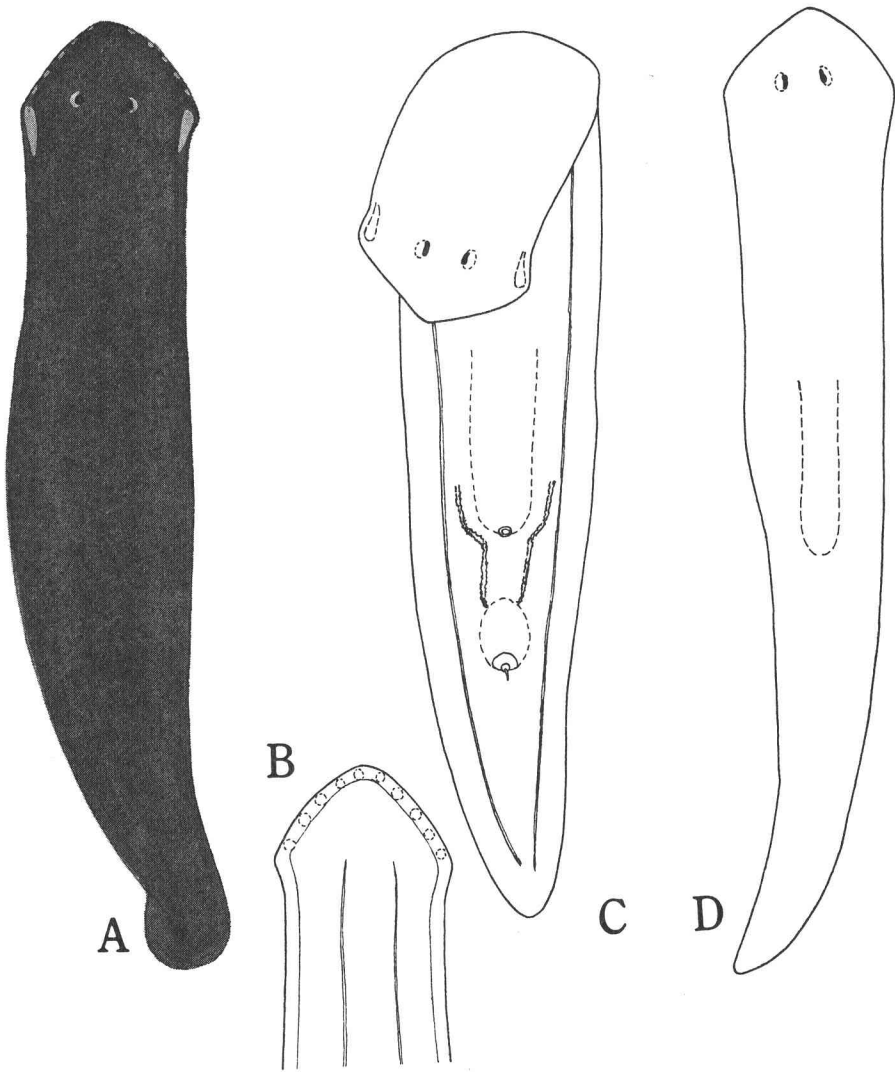


Fig. 2. *Dugesia batuensis* BALL, 1970 (A, B, and C) and *Dugesia* sp. (species of Thailand) (D). A: an epigeic form from the Sungai Gombak in Malaya (non-sexual specimen; Specimen Lot No. 765 group). B: ventral view of the head of the same specimen as A. C: another sexually mature specimen from the Sungai Gombak (Specimen No. 765 g). D: sexually immature specimen from the Huai Pu River in Thailand (Specimen Lot No. 769 group).

conspicuous on both sides of the head. There are white, small stipples or sensory spots (10 in numbers) at the anterior margin of the body (Fig. 1 A and B).

The pharynx is inserted at about the middle of the body (it is nearly one-fifth of the body length). The genital pore is situated in the midline somewhat frontal level of the middle of the postpharyngeal region. A part of the spermiducal vesicles

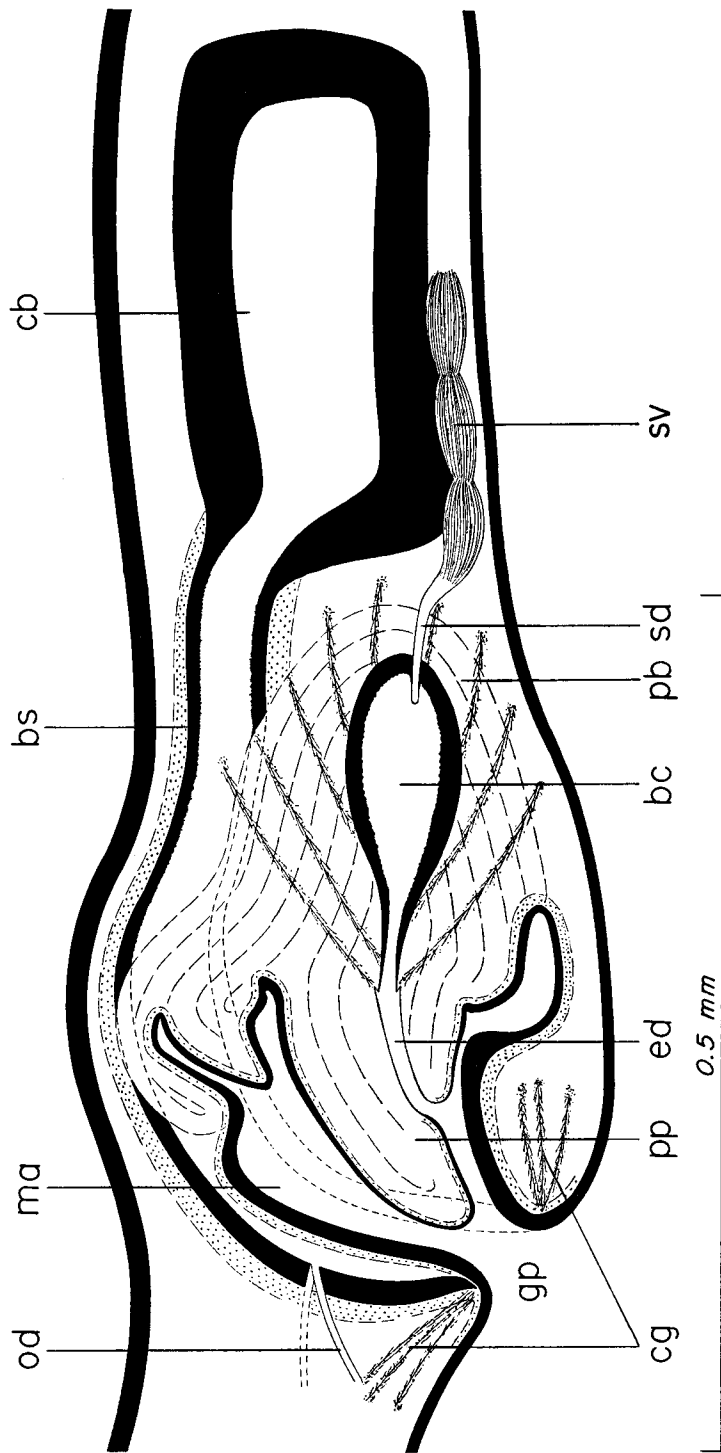


Fig. 3. Diagram showing the sagittal view of the copulatory apparatus of *Dugesia batuensis* BALL, 1970, from the Sungai Gombak in Malaya (Specimen No. 765 g). bc, bulbar cavity; bs, bulbar stalk; cb, copulatory bursa; cg, cement gland; ed, ejaculatory duct; gp, genital pore; ma, male antrum; od, ovovitelline duct; pb, penis bulb; pp, penis papilla; sd, sperm duct; sv, spermiducal vesicle; v, vagina.

is seen from the ventral side (Fig. 1 C).

**Internal Characters.** In histological sections the dorsal epithelium is thicker than the ventral. It is observed that both the epithelia of the present epigeal form are thinner than those of the hypogeal form from the type locality (Pl. 1, Figs. A, B and C). There are no histological peculiarities in the pharynx musculatures in the epigeal form. The anterior intestinal trunk bears 10 to 15 branches on each side; each posterior trunk has 15 to 18 short lateral branches. Most of the specimens examined in the slides were infected by a species of Nematoda found in the pharynx tissue.

The photomicrographs of the sagittal sections of the eyes in both epigeal and hypogeal forms of *Dugesia batuensis* are shown in Figures A, B and C in Plate 1. The histological structure of the eyes in the hypogeal form is normal. However, the pigment cell layer and the visual cells of the hypogeal form are less developed than those of the epigeal form.

Regarding the genital anatomy a pair of very large ovaries, the dorsal testes and the yolk glands are typical in the epigeal form. A sagittal view of the copulatory apparatus of a specimen from the Sungai Gombak locality is shown in Figure 3 (see also Pl. 1, Fig. D, Pl. 2, Figs. A and B). In short, the main characters are the following: penis bulb large with a wide bulbar cavity into which sperm ducts enter separately; asymmetric penis papilla moderate and with a valve or diaphragm at its basal part; separation of a bulbar cavity and an ejaculatory duct by a diaphragm (it is very small in the slides examined; No. 765 g) and external opening of an ejaculatory duct on the under side of a penis near the tip; copulatory bursa large, with a rather wide bursal canal (bursa stalk with thick muscle layers); vagina developed into which ovovitelline ducts enter separately.

The size of a copulatory apparatus of the present material from the epigeal locality is somewhat small than that of the specimens from the Batu Caves (see KAWAKATSU, 1972 b, p. 342, Fig. 3). The valve or diaphragm surrounding at the basal part of a penis papilla and the muscles of a bursa stalk are somewhat less developed in the epigeal form than those of the hypogeal form. The copulatory bursa of the former is larger than that of the latter.

**Material.** Ten sets of sagittal serial sections (Specimen No. 765 a-k) and remaining specimens in alcohol are preserved in KAWAKATSU's room of Fuji Women's College, Sapporo.

***Dugesia* sp. (species of Thailand). Fig. 2 (D)**

There are no sexually mature specimens in the material examined. Although the real identification of these planarians from Thailand is impossible, the short description of them will be given below.

**External and Internal Characters.** The preserved large specimen from the Huai Pu River locality is about 8 mm long and 1 mm wide. The head is of a subtriangular form with bluntly prominent auricles. There is no distinct narrowing

behind the head. The color of the dorsal surface is uniform light brown. There are two small eyes on the dorsal side of the head; the distance between them is about one-third the width of the head at the level of eyes. The non-pigmented areas around each eye is conspicuous. The slender pharynx is inserted at about the middle of the body. In histological sections (4 specimens of the Specimen Lot Nos. 767 and 769 groups), the internal muscle zone of the pharynx shows a typical arrangement of the family Planariidae. The outer pharynx musculatures consist of two layers.

Material. Four sets of sagittal sections (Specimen Nos. 767 a and b, 769 a and b) and remaining specimens in alcohol are preserved in KAWAKATSU's room of Fuji Women's College, Sapporo.

### Taxonomic Remarks

*Dugesia batuensis* was described originally as a non-pigmented, true cave-dwelling form inhabiting in the dark zone of the Batu Caves (cf. BALL, 1970). After his paper was published, KAWAKATSU (1972 b) demonstrated that this species is a low pigmented form with two small eyes (see also KAWAKATSU, 1972 c; MITCHELL and KAWAKATSU, In press). From the result of the present study it can be demonstrated that a dark pigmented form of this species is distributed in the epigeal stream in the vicinity of Kuala Lumpur. The differences in the external appearance between the hypogean and epigeal forms of *Dugesia batuensis* are not adequate enough to justify their sub-specific separation. Although the hypogean form from the Batu Caves shows a slight degree of adaptation as a cave inhabitant, it may be rather young as a cave-dwelling population. From this viewpoint, the words "no pigment" in the Dr. BALL's original definition of *Dugesia batuensis* (1970, p. 284) should be eliminated.

*Dugesia* sp. (species of Thailand) is the first record of freshwater planarian in Thailand. Judging from the external appearance of this form, this non-identified species shows a slight similarity to *Dugesia burmaensis* (KABURAKI, 1918) from Inlé Lake in Burma.

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## Plate 1

- A, B and C. Photomicrographs showing the sagittal view of the eyes of *Dugesia batuensis* BALL, 1970. The same magnifications.
- A. The epigeal form from the Sungai Gombak (Specimen No. 765 g).
- B and C. Two specimens of the hypogean form from the Batu Caves. B. Specimen No. 764 b. C. Specimen No. 764 e.
- D. Enlarged photomicrograph of the part of the bursa stalk of *Dugesia batuensis* BALL, 1970, from the Sungai Gombak (Specimen No. 765 g).  
buc, bursal canal; pcl, pigment cell layer of the eyes; vc, visual cell.

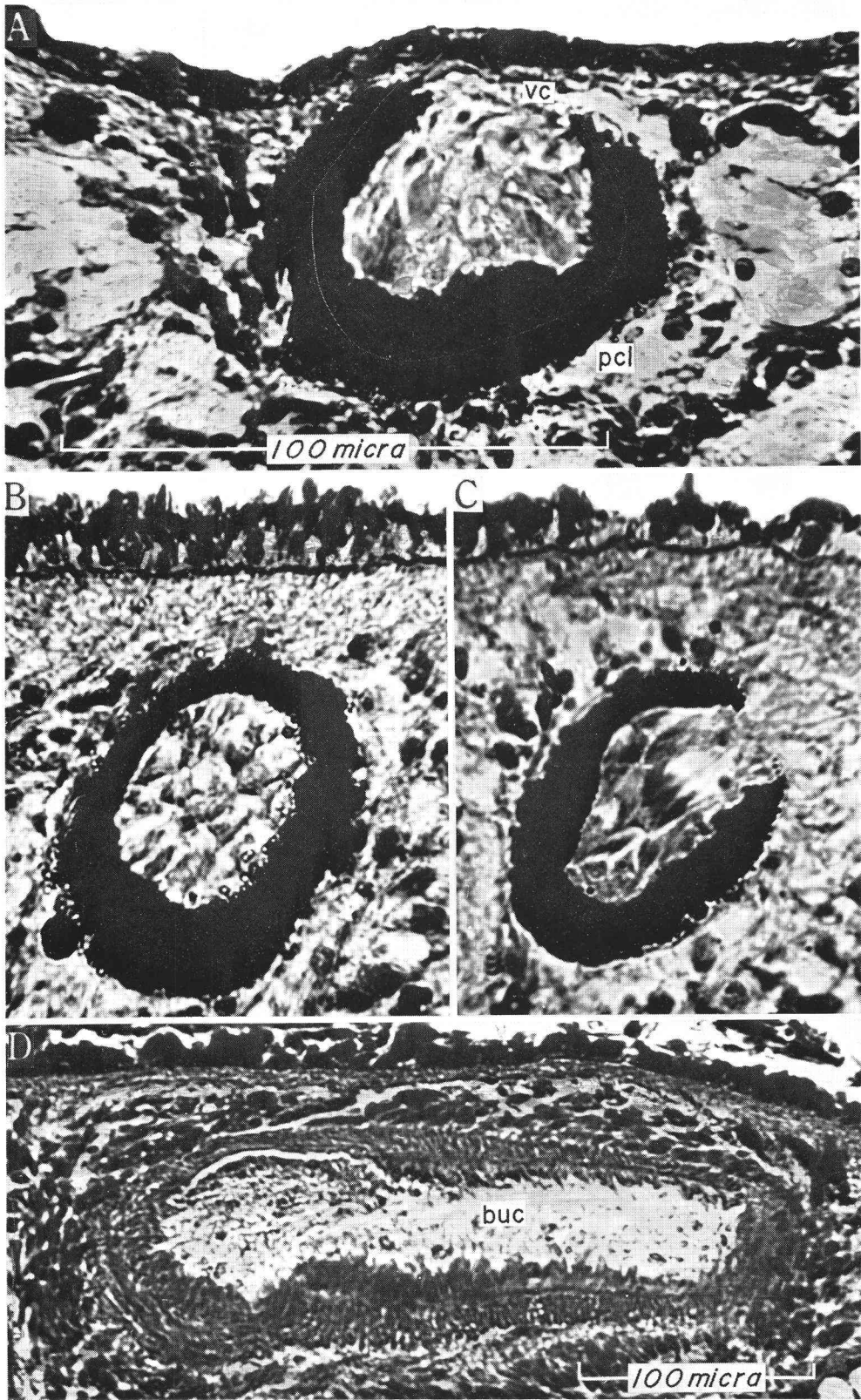


Plate 2

- A and B. Photomicrographs showing the parts of the copulatory apparatus of *Dugesia batuensis* BALL, 1970, from the Sungai Gombak. The same magnifications.
- A. Copulatory apparatus. Specimen No. 765 g.
- B. Copulatory apparatus. Specimen No. 765 g.  
ed, ejaculatory duct; gp, genital pore; ma, male antrum; od, ovovitelline duct; pb, penis bulb; pp, penis papilla; sd, sperm duct.

